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# GEOPHYSICAL VARIABLES AND BEHAVIOR: LXII. TEMPORAL COUPLING OF UFO REPORTS AND SEISMIC ENERGY RELEASE WITHIN THE RIO GRANDE RIFT SYSTEM: DISCRIMINATIVE VALIDITY OF THE TECTONIC STRAIN THEORY[1,2]

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*Summary.*—Persistent, moderately strong temporal correlations ($0.7 < rho < 0.8$) between the numbers of UFO reports (UFORs) and the amount of seismic energy release were evident for approximately 30 years within New Mexico and Colorado, surrounding the active Rio Grande Rift System. The hypothetical construct of a moving "strain field" was suggested by the gradually closer occurrence of UFORs over time to an imminent epicenter. Tests of discriminative validity involved partial correlation analyses for different types of UFORs. The results indicated that only classic luminous phenomena, similar to historical descriptions of earthquake lights, were strongly correlated with the release of seismic energy within the area. Anomalous luminosities similar to conventional transients, such as meteors, or putative extraterrestrial intelligence, were not correlated significantly with the energy release. Both the validity and reliability of the tectonic strain theory were supported.

More than 15 studies (e.g., Derr & Persinger, 1986, 1989, 1990a, 1990b; Persinger, 1983, 1984; Persinger & Derr, 1985) have shown that the numbers of reports of unidentified flying objects (UFORs) within a region are associated in time with the release of seismic energy. The strong temporal relationships between UFORs and the dissipation of strain energy are optimally seen when increments of 1 mo. to 6 mo. are analyzed over decades for the geological region. Conspicuous increases or unprecedented numbers of UFORs within a region appear to occur when the amount of imminent energy release exceeds $10^{17}$ ergs per 6-mo. increment. All of these consistent patterns strongly support the validity of the tectonic strain theory which states that most UFORs are descriptions of luminous phenomena that are generated by the same types of stresses as those that evoke seismicity.

Although the tectonic strain theory has demonstrated reliability, it should also display discriminative validity. Because the primary measures of the luminous phenomena at this time are some variant of reports of UFO phenomena, not all types of UFORs should be significantly correlated with the release of seismic energy. In addition, the spatial movement of UFORs over time towards or away from an imminent epicenter should further sup-

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port the existence of one of the hypothetical concepts of the tectonic strain theory: UFORs accompany a physical process that moves through the crust as the stresses that precede an earthquake accumulate.

The two states, New Mexico (NM) and Colorado (CO), that compose the major portion of the Rio Grande rift zone were selected for analyses. This rift is a major intracontinental extensional structure that has been active for the last 30 million years. It extends into west Texas and northern Mexico and has been the locus of classic luminous phenomena and UFO reports for over 100 years. Our preliminary, unpublished analyses of incomplete luminous phenomena data within New Mexico between 1940 and 1980 indicated a correlation (*rho*) of 0.74 between the numbers of luminous phenomena per 1° latitude-longitude units and the numbers of earthquakes within those units. This suggested using a more comprehensive data base.

For the present study, all UFORs were derived from the Center for UFO Studies (CUFOS) as compiled by Saunders (1978) for the years between 1945 and 1977. After addition of latitude and longitude data for about 60% of the cases that were not supplied with this information, 99% of the cases contained the day, month, year, latitude-longitude and class of report. Unlike previous analyses, redundant cases (about 10% of the total) within the UFOCAT were eliminated. A redundant case was defined as any repetition of reports that contained the same hour, day, month, year and latitude-longitude; most of the redundant reports appeared to be multiple entries of the same event. Consequently, there were a total of 830 reports within New Mexico and 664 within Colorado for this period.

The class of report was partitioned into four categories in a manner similar to procedures applied to the central U.S.A. (Derr & Persinger, 1990b): unclassified, sky lights, specific luminous phenomena (SLP), and exotic cases. Using CUFOS criteria, these groups corresponded to unclassified, Types 0 through 2, Types 3 through 6, and Types 7 through 9, respectively. The percentage of total UFORs for each state (New Mexico and Colorado, respectively) within each group of reports were unclassified (44%, 54%), skylights (23%, 27%), specific luminous phenomena (28%, 16%), and exotic (4%, 3%) cases. Because numbers of unclassified reports are most strongly correlated with and load on the same factor (i.e., a shared source of variance) as SLP, they were combined to form the category general luminous phenomena (GLP).

Earthquake data were derived from the US Geological Survey hypocenter data file (HDF) and are considered to be essentially complete for magnitudes greater than 3 since 1962; from the years 1945 through 1962 the file should be complete only for magnitudes greater than 4. Seismic events for which no magnitude was given were allocated a value based upon an extrapolation between modified Mercalli intensity and magnitude relation-

ships. Energy release per 6-mo. interval and optimal (variable) interval within the two states and the 100-km area surrounding the perimeter of these states was calculated according to the formula: $E = 10^{(1.5\ m + 11.4)}$. Seismicity within surrounding areas was included because luminous phenomena often occur at distances away from the imminent epicenter. The variable interval was determined by the intrinsic fluctuation (trough to trough) in numbers of UFORs. All analyses employed SPSS$^{x}$ software and a VAX computer.

The first step was to determine whether a systematic relationship between numbers of UFORs and the amount of energy released existed within this region. For fixed, 6-mo. increments of analyses significant positive correlations (at strengths noted previously) were observed The discrepancy between the *r* (0.59) and *rho* (0.69) reflects the mild contribution of outliers to the effect (Fig. 1). Analyses according to the variable optimal intervals, a procedure that would presumably demonstrate the strongest possible relationship, displayed a correlation of only 0.79 between the numbers of luminous phenomena and the amount of energy release. The average of the optimal temporal increments was $7 \pm 2$ mo.

Step two was to determine the discriminative validity of the prediction. If specific luminous phenomena and general luminous phenomena are representative of actual physical luminous phenomena, then they should demonstrate the strongest correlation with the release of seismic energy. To reduce the skewness of distribution for the four categories of UFORs, square root transformations were completed. Pearson correlations between energy release per increment and numbers of reports per category per increment were: specific luminous phenomena (0.63), general luminous phenomena (0.69), skylights (0.47), and exotic (0.43) cases.

Because significant intercorrelations ($r > 0.50$) existed *between* pairs of these categories, partial correlation analyses were completed. When the variance associated with exotic cases was held constant, the correlation between general luminous phenomena and energy release was 0.60; however, when the variance associated with general luminous phenomena was held constant, the correlation between exotic cases and energy release was −0.06 (ns). The partial correlation between general luminous phenomena and energy release was 0.59 when the variance associated with skylights was held constant. When the variance associated with general luminous phenomena was held constant the partial correlation between skylights and energy release was not statistically significant ($r = 0.19$). These results suggest that the mildly strong zero-order correlation between the categories that served as case controls: skylights and exotic cases, and energy release occurred indirectly because they were correlated with the specific luminous phenomena.

The major hypothetical construct of the theory is that some process,

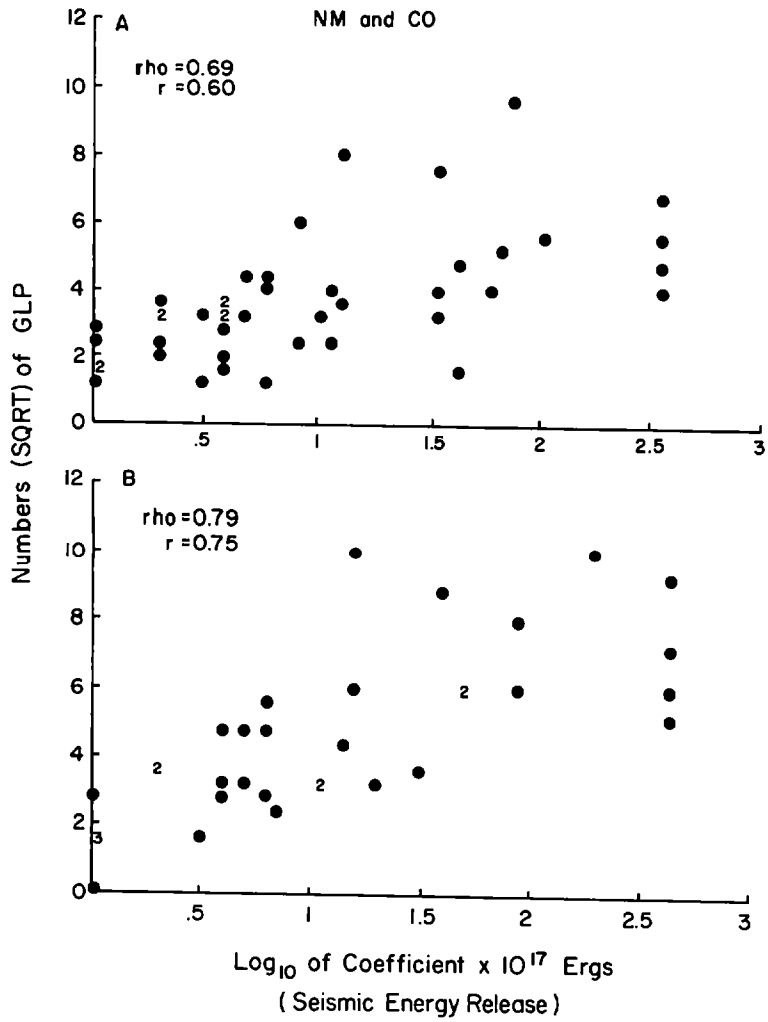


FIG. 1. (A) Correlation between the square root of the numbers of general luminous phenomena (GLP) per six-month increment and the amount of seismic energy release per six-month increment within New Mexico and Colorado. (B) Correlation between the square root of the numbers of general luminous phenomena per optimal temporal increment and the amount of seismic energy release during these increments for the same area

described metaphorically as a "strain field," moves through the earth's crust into areas of increasing stress and imminent fracturing. As the process moves beneath human habitats, the luminous phenomena are generated and human observers report UFOs, especially those with irregular movements, rotations,

and varying colors. If this construct is correct, then there should be systematic changes over time in distances of luminous phenomena from imminent epicenters.

To reduce the potential confounding effects of strain fields preceding other, nearby earthquakes, a period of time (1950.5 through 1952.8) that contained a strong quake and a minimum number of other quakes was determined. During this period a total of 149 UFO reports occurred within the two states. Over this period the correlation between the distance of the UFORs from the imminent epicenter (near Los Alamos, NM) and the day of its occurrence was $-0.52$ ($p < .001$). The increase in proximity over time to the imminent epicenter approached two asymptotes resulting in two discernable slopes; they suggest that whatever process was associated with the UFORs moved toward the epicenter at speeds between 100 to 500 km/year. However, during a comparable period after the earthquake: (1) there was no significant correlation ($r = .10$, $p > .05$) between the distance of UFORs and time and (2) the numbers of UFORs within 100 km of the epicenter approached 0.

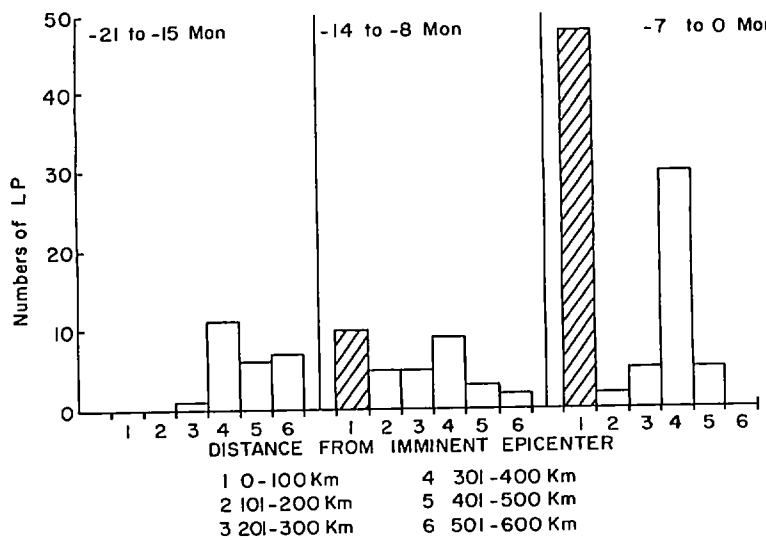


FIG. 2. Numbers of luminous phenomena reported within concentric distances of 100 km from the imminent epicenter of a moderate strength earthquake during three successive intervals before its occurrence

Fig. 2 displays the numbers of luminous phenomena per 100-km increment from the imminent epicenter for the three 7-mo. intervals before the earthquake. Luminous phenomena were not reported within 200 km of the

epicenter more than 15 to 21 mo. before the quake. However, during the 7 mo. that preceded the quake, the numbers increased dramatically. Additional analyses indicated that most UFOR were northeast of the imminent epicenter until about 6 to 8 mo. before the quake when they suddenly appeared within 100 km and towards the southwest.

These analyses have again demonstrated a strong consistent temporal relationship between the numbers of UFORs within a region and the release of seismic energy. In addition, both zero-order and partial correlation analyses have shown that only specific types of UFORs, those most typically associated with classic unusual luminous phenomena, are significantly correlated with the release of seismic energy. Skylights (about 25% of all cases), that likely include more conventional phenomena (such as meteorites), and exotic cases (3% of all cases), that are more likely to include other mechanisms, displayed the least or no statistically significant correlations with seismic energy release. The results are similar to those found for luminous phenomena and energy release within the central U.S.A. (Derr & Persinger, 1990b). All three results, (1) the strong temporal correlation between UFORs and seismic energy release, (2) the differential association between energy release and specific types of reports of luminous phenomena, and (3) the change in distance over time between luminous phenomena and the imminent epicenter for at least one earthquake, support the reliability and validity of the tectonic strain theory.

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